

Listing of claims:

1. (Currently Amended) An hydraulic system for a wheeled loader having a loader arm assembly which carries a working implement and which is connected to the body and which is movable between raised and lowered positions by means of a hydraulic actuator device and in which a hydraulic accumulator is connected to the hydraulic actuator device wherein the loader arm assembly is connected at, or adjacent to, the rear end thereof to the body at, or adjacent to, the rear end thereof so that the loader arm assembly extends forwardly whereby, in a lowered position of the loader arm assembly, the working implement is disposed in front of the body and wherein the actuator device includes a cylinder receiving a piston, the cylinder having a first chamber at one side of the piston and a second chamber at a second side of the piston, each chamber of the cylinder being connected to a selection valve means adapted to feed fluid under pressure to the first chamber of the cylinder via a first feed line and to receive fluid at a lower pressure from the second chamber of the cylinder via a second feed line in order to raise the loader arm assembly or to feed fluid under pressure to the second chamber of the cylinder via the second feed line and receive fluid at a lower pressure from the first chamber of the cylinder via the first feed line to lower the loader arm assembly, first and second control valves, the first control valve movable between a first position in which passage of hydraulic fluid is permitted only from the hydraulic accumulator toward the first chamber, and a second position in which passage of hydraulic fluid is permitted; in two directions between the hydraulic accumulator and the first chamber, the second control valve movable between a first position in which passage of hydraulic fluid therethrough is prevented in both directions and a second position in which passage of hydraulic fluid therethrough is permitted in both directions, the first control valve being connected between the first chamber and the hydraulic accumulator and the second control valve being connected between the second chamber and a low pressure region, and there

being a check valve assembly connected between the first chamber and the selection valve means, the first control valve in fluid communication with the first feed line at a point between the first chamber and the check valve assembly, the check valve assembly including a first component arranged to prevent fluid under pressure from passing from the first chamber to the selection valve means but permitting fluid under pressure to pass from the selection valve means to the first chamber, the check valve assembly including a second component arranged to prevent the passage of hydraulic fluid in both directions, the second component responsive to hydraulic fluid pressure increases in the second chamber to open the check valve to permit fluid flow from the first chamber to the selection valve means when the second chamber is pressurized; and

a ride improvement means, the ride improvement means activated by selectively shifting the first and second control valves to their respective first and second positions, the first and second control valves when in the second position arranged to route hydraulic fluid to and from the accumulator in response to pressure changes in the first chamber and to and from the low pressure area in response to a pressure changes in the second chamber, the ride improvement means arranged to permit raising of the loader arm assembly when the first and second control valves are in the second position, the ride improvement means further arranged to permit [[and]] lowering of the loader arm assembly when the first [[and second control valves are in the second positions]] control valve is in the second position and the second control valve is in the first position.

2. (Original) A system according to claim 1 wherein the selection valve is manually operable.

3. (Previously Presented) A system according to claim 1 wherein the control valves are electrically operated solenoid valves to which current is supplied by a manually operable switch means.

4. (Currently Amended) A system according to claim 2 wherein the selection valve is provided with a switch means to sense the position of the selection valve to close said second control valve when the arm is lowered and said first control [[valves are]] is open.

5. (Currently Amended) A system according to claim 1 wherein the accumulator and the control valves and the check valves valve assembly are mounted directly on the cylinder.

6. (Currently Amended) A system according to claim 1 wherein at least one of said accumulator, control valves, check valve assembly and connecting pipes are made of metal.

7. (Currently Amended) A hydraulic system having a ride improvement mode and for use on a wheeled loader having a forwardly extending loader arm assembly mounted adjacent a rear end of the wheeled loader, the hydraulic system comprising:

a hydraulic cylinder operatively connected to the loader arm for raising and lowering the loader arm, the hydraulic cylinder having a first chamber and a second chamber disposed on opposite sides of a piston;

a selection valve operatively connected to the hydraulic cylinder via a first line and a second line, the selection valve arranged to feed pressurized hydraulic fluid to the first chamber via the first line and to receive hydraulic fluid at a lower pressure from the second chamber via the second line in order to raise the loader arm assembly, the selection valve further arranged to feed pressurized hydraulic fluid to the second chamber via the second line and to receive hydraulic fluid at a lower pressure from the first chamber via the first line in order to lower the loader arm assembly;

an accumulator connected to the first feed line via a first control valve, the first control valve movable between a first position in which hydraulic fluid flow is permitted only

from the accumulator to the first feed line and a second position in which hydraulic fluid flow is permitted between the accumulator and the first feed line in both directions;

a low pressure area connected to the second feed line by a second control valve, the second control valve movable between a first position in which passage of hydraulic fluid between the second feed line and the low pressure area is prevented in both directions and a second position in which hydraulic fluid flow between the second feed line and the low pressure area is permitted in both directions; and

a check valve assembly operatively connected to both the first and second feed lines, the check valve assembly having a first mode in which hydraulic fluid flow is permitted in only a single direction, the single direction from the selection valve means to the first chamber, the check valve assembly having a second mode in which hydraulic fluid flow is permitted from the first chamber toward the selection valve, the check valve assembly arranged to respond to pressure in the second feed line to open the first feed line between the hydraulic cylinder and the selection valve;

the first and second control valves when both shifted to the second positions arranged to provide a hydraulic suspension to the loader arm assembly, the hydraulic suspension arranged to provide hydraulic fluid flow between the first chamber and the hydraulic accumulator in response to pressure changes in the first chamber, the hydraulic suspension further arranged to provide hydraulic fluid flow between the second chamber and the low pressure area in response to pressure changes in the second chamber, the first and second control valves and the check valve assembly cooperating to permit raising [[and lowering]] of the loader arm assembly when the first and second control valves are in the second position, the first and second control valves and the check valve assembly further cooperating to permit lowering of the loader arm assembly when the first control valve is in the second position and the second control valve is in the first position.

8. (Canceled)

9. (Canceled)

10. (Currently Amended) A hydraulic system having a ride improving hydraulic circuit and for use on a wheeled loader having a forwardly extending loader arm assembly mounted adjacent a rear end of the wheeled loader, the hydraulic system comprising:

a hydraulic cylinder operatively connected to the loader arm for raising and lowering the loader arm, the hydraulic cylinder having a first chamber and a second chamber disposed on opposite sides of a piston;

a selection valve operatively connected to the hydraulic cylinder via a first line and a second line, the selection valve arranged to feed pressurized hydraulic fluid to the first chamber via the first line and to receive hydraulic fluid at a lower pressure from the second chamber via the second line in order to raise the loader arm assembly, the selection valve further arranged to feed pressurized hydraulic fluid to the second chamber via the second line and to receive hydraulic fluid at a lower pressure from the first chamber via the first line in order to lower the loader arm assembly;

an accumulator connected to the first feed line via a first control valve, the first control valve movable between a first position in which hydraulic fluid flow is permitted in only a single direction from the accumulator to the first chamber and a second position in which hydraulic fluid flow is permitted between the accumulator and the first chamber in both directions;

a low pressure area connected to the second feed line by a second control valve, the second control valve movable between a first position in which passage of hydraulic fluid between the second feed line and the low pressure area is prevented in both directions and a second position in which hydraulic fluid flow between the second feed line and the low pressure area is permitted in both directions; and

a hose burst check valve assembly disposed in the first feed line between the first chamber and the selection valve, the first control valve intersecting the first feed line between the check valve assembly and the first chamber, the check valve assembly having a first mode arranged to prevent fluid under pressure passing from the first chamber to the selection valve

but permitting fluid under pressure to flow from the selection valve to the first chamber, the check valve assembly having a second mode arranged to permit fluid flow from the first chamber toward the selection valve, the check valve assembly arranged to shift to the second mode in response to a pressure increase in the second chamber to open the check valve assembly to permit fluid flow from the first chamber to the selection valve when the second chamber is pressurized, the check valve assembly arranged to cooperate with the first and second control valves to provide a ride improving mode activated upon shifting both the first and second control valves to the second position to route hydraulic fluid between the first chamber and the accumulator via the first control valve and between the second chamber and the low pressure area via the second control valve, the check valve assembly further arranged to permit raising of the loader arm assembly when the first and second control valves are both in the second position.

11.(Canceled)

12.(Canceled)

13. (Currently Amended) The device of claim 10, wherein the check valve assembly is further arranged to permit lowering of the loader arm assembly when in the ride improving mode, the second control valve arranged to shift back to the first position when lowering the loader arm assembly when in the ride improving mode.

14. (Previously Presented) A ride improving hydraulic circuit for a loader arm of a wheeled loader, the hydraulic circuit comprising:

a hydraulic cylinder operatively connected to the loader arm for raising and lowering the loader arm, the hydraulic cylinder having a first chamber and a second chamber disposed on opposite sides of a piston;

a selection valve operatively connected to the hydraulic cylinder via a first line and a second line, the selection valve arranged to feed pressurized hydraulic fluid to the first chamber via the first line and to receive hydraulic fluid at a lower pressure from the second chamber via the second line in order to raise the loader arm, the selection valve further arranged to feed pressurized hydraulic fluid to the second chamber via the second line and to

receive hydraulic fluid at a lower pressure from the first chamber via the first line in order to lower the loader arm;

a valve assembly disposed in the first line between the first chamber and the selection valve, the valve assembly including a check valve arranged to prevent fluid under pressure passing from the first chamber to the selection valve but permitting fluid under pressure to flow from the selection valve to the first chamber, the valve assembly including a relief valve shiftable from a first position to a second position, the first position arranged to prevent fluid flow between the selection valve and the first chamber in both directions, the second position arranged to permit fluid flow from the first chamber toward the selection valve, the valve assembly arranged to shift to the second mode in response to a pressure increase in the second chamber;

an accumulator operatively coupled to the first line by a first control valve, the first control valve in flow communication with the first line at a point between the valve assembly and the first chamber, the first control valve movable between a first position in which hydraulic fluid flow is permitted in only a single direction from the accumulator to the first chamber and a second position in which hydraulic fluid flow is permitted between the accumulator and the first chamber in both directions;

a low pressure area operatively coupled to the second line by a second control valve, the second control valve movable between a first position in which passage of hydraulic fluid between the second line and the low pressure area is prevented in both directions and a second position in which hydraulic fluid flow between the second feed line and the low pressure area is permitted in both directions; and

a ride improving circuit, the ride improving circuit arranged to permit fluid flow in both directions between the accumulator and the first chamber when the first control valve is

in the second position and further arranged to permit fluid flow in both directions between the second chamber and the low pressure region when the second control valve is in the second position, the first and second chambers hydraulically isolated from each other when both the first and second control valves are in the second position, and wherein the check valve and the relief valve are arranged to permit the loader arm to be raised when the relief valve is in the first position and both control valves are in the second position, and further wherein the check valve and the relief valve are arranged to permit the loader arm to be lowered when the first control valve and the relief valve are in the second position and the second control valve is in the first position, the relief valve arranged to shift to the second position upon pressurization of the second chamber when lowering the loader arm.

15. (New) A ride improving hydraulic circuit for a loader arm of a loader and having hose burst protection, the hydraulic circuit comprising:

a hydraulic cylinder operatively connected to the loader arm for raising and lowering the loader arm, the hydraulic cylinder having a first chamber and a second chamber disposed on opposite sides of a piston;

a selection valve operatively connected to the hydraulic cylinder via a first line and a second line, the selection valve arranged to feed pressurized hydraulic fluid to the first chamber via the first line and to receive hydraulic fluid at a lower pressure from the second chamber via the second line in order to raise the loader arm, the selection valve further arranged to feed pressurized hydraulic fluid to the second chamber via the second line and to receive hydraulic fluid at a lower pressure from the first chamber via the first line in order to lower the loader arm;

a hose burst check valve operatively coupled to the hydraulic cylinder via a rigid pipe connection and coupled to the first line at a first point and a second point, the hose burst check valve operatively coupled to the first chamber by a rigid pipe connection and providing

hose burst protection between the check valve and the selection valve, the hose burst check valve arranged to prevent fluid under pressure from passing from the first chamber toward the selection valve but permitting fluid under pressure to flow from the selection valve toward the first chamber;

a relief valve disposed in the first line between the first point and the second point, the relief valve shiftable from a first position to a second position in response to pressure changes in the second line, the first position arranged to prevent fluid flow between the selection valve and the first chamber in both directions, the second position arranged to permit fluid flow from the first chamber toward the selection valve, the relief valve arranged to shift to the second position in response to a pressure increase in the second chamber;

an accumulator mounted to the hydraulic cylinder and operatively coupled to the hydraulic cylinder;

a first control valve disposed in the first line and connected to both the accumulator and the first chamber, the first control valve in flow communication with the first feed line between the hose burst protection valve and the first chamber, the first control valve movable between a first position in which hydraulic fluid flow is permitted in only a single direction from the accumulator to the first chamber and a second position in which hydraulic fluid flow is permitted between the accumulator and the first chamber in both directions;

a low pressure area;

a second control valve operatively connecting the second line to the low pressure area, the second control valve movable between a first position in which hydraulic fluid flow between the second line and the low pressure area is prevented in at least one direction and a

second position in which hydraulic fluid flow between the second feed line and the low pressure area is permitted in both directions;

the first control valve, the second control valve, and the hose burst protection valve cooperating to provide a ride improving circuit having an active and inactive configuration, the ride improving circuit arranged to permit raising and lowering the loader arm while the ride improving circuit is active and when the ride improving circuit is inactive;

the active configuration arranged to permit raising the loader arm by shifting each of the control valves to the second position with the relief valve biased toward the first position; and

the active configuration further arranged to permit lowering the loader arm by shifting the first control valve to the second position and the second control valve to the first position, the relief valve shiftable toward the second position in response to pressure increases in the second line.

16.(New) The hydraulic circuit of claim 15, including a sensor switch operatively coupled to the selection valve and the second control valve, the sensor switch arranged to sense the position of the selection valve and to close the second control valve when the second chamber is being pressurized.

17. (New) A ride improving hydraulic circuit for a loader arm of a loader and having hose burst protection, the hydraulic circuit comprising:

a hydraulic cylinder operatively connected to the loader arm for raising and lowering the loader arm, the hydraulic cylinder having a first chamber and a second chamber disposed on opposite sides of a piston;

a selection valve operatively connected to the hydraulic cylinder via a first line and a second line, the selection valve arranged to feed pressurized hydraulic fluid to the first

chamber via the first line and to receive hydraulic fluid at a lower pressure from the second chamber via the second line in order to raise the loader arm, the selection valve further arranged to feed pressurized hydraulic fluid to the second chamber via the second line and to receive hydraulic fluid at a lower pressure from the first chamber via the first line in order to lower the loader arm;

a hose burst protection valve operatively coupled to the hydraulic cylinder and disposed in the first line, the hose burst protection valve operatively coupled to the first chamber by a rigid pipe connection disposed in the first line, the hose burst protection valve comprising a check valve arranged to prevent fluid under pressure from passing from the first chamber toward the selection valve but permitting fluid under pressure to flow from the selection valve toward the first chamber;

the hose burst protection valve further comprising a relief valve shiftable from a first position to a second position and connected to the second chamber by a connection, the first position arranged to prevent fluid flow between the selection valve and the first chamber in both directions, the second position arranged to permit fluid flow from the first chamber toward the selection valve, the relief valve arranged to shift to the second position in response to a pressure increase in the second chamber;

an accumulator mounted to the hydraulic cylinder and operatively coupled to the hydraulic cylinder by a connection;

a first control valve disposed in the first line and connected to the accumulator and the first chamber, the first control valve in flow communication with the hose burst valve and the first chamber, the first control valve movable between a first position in which hydraulic fluid flow is permitted in only a single direction from the accumulator to the first chamber and a second position in which hydraulic fluid flow is permitted between the accumulator and the first chamber in both directions;

a low pressure area;

a second control valve operatively connecting the second line to the low pressure area;

the first control valve, the second control valve, and the hose burst protection valve cooperating to provide a ride improving circuit having an active configuration and an inactive configuration, the ride improving circuit arranged to permit raising and lowering the loader arm while the ride improving circuit is in the active configuration and when in the inactive configuration;

the second control valve arranged to prevent flow from the second line to the low pressure area when the ride improving circuit is in the inactive configuration;

the ride improving circuit arranged to permit raising the loader arm in the active configuration by shifting each of the first and second control valves to the second position with the relief valve biased toward the first position; and

the ride improving circuit further arranged to permit lowering the loader arm in the active configuration achieved by shifting the first control valve to the second position in the second control valve to the first position, the relief valve shiftable toward the second position in response to pressure increases in the second line.

18. (New) A ride improving hydraulic circuit for a loader arm of a loader and having hose burst protection, the hydraulic circuit comprising:

a hydraulic cylinder operatively connected to the loader arm for raising and lowering the loader arm, the hydraulic cylinder having a first chamber and a second chamber disposed on opposite sides of a piston;

a selection valve operatively connected to the hydraulic cylinder via a first line and a second line, the selection valve arranged to feed pressurized hydraulic fluid to the first

chamber via the first line and to receive hydraulic fluid at a lower pressure from the second chamber via the second line in order to raise the loader arm, the selection valve further arranged to feed pressurized hydraulic fluid to the second chamber via the second line and to receive hydraulic fluid at a lower pressure from the first chamber via the first line in order to lower the loader arm;

a hose burst check valve mounted to the hydraulic cylinder and coupled to the first line at a first point and a second point, the hose burst check valve operatively coupled to the first chamber, the hose burst check valve arranged to prevent fluid under pressure from passing from the first chamber toward the selection valve but permitting fluid under pressure to flow from the selection valve toward the first chamber;

a relief valve disposed in the first line between the first point and the second point, the relief valve shiftable from a first position to a second position in response to pressure changes in the second line, the first position arranged to prevent fluid flow between the selection valve and the first chamber in both directions, the second position arranged to permit fluid flow from the first chamber toward the selection valve, the relief valve arranged to shift to the second position in response to a pressure increase in the second chamber;

an accumulator operatively coupled to the hydraulic cylinder;

a low pressure area;

a control valve operatively connecting the second line to the low pressure area, the second control valve movable between a first position in which hydraulic fluid flow between the second line and the low pressure area is prevented in at least one direction and a second position in which hydraulic fluid flow between the second feed line and the low pressure area is permitted in both directions;

the control valve and the hose burst protection valve cooperating to provide a ride improving circuit having an active and inactive configuration, the ride improving circuit arranged to permit raising and lowering the loader arm while the ride improving circuit is active and when the ride improving circuit is inactive;

the active configuration arranged to permit raising the loader arm upon shifting the valve to the second position with the relief valve in the first position; and

the active configuration further arranged to permit lowering the loader arm upon shifting the control valve to the first position and with the relief valve shifted toward the second position in response to pressure increases in the second line.